

## Exercises for “Autonomous Grasping”

### WS 2017/18 Sheet 0

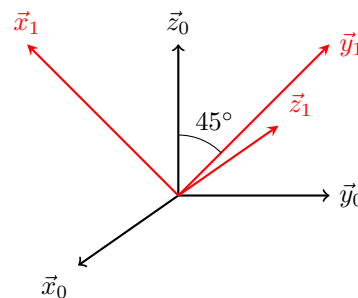
Due on: 13.10.2017

**Task 0.1, Rotation matrix:** Compute the matrix  $R$  for the resulting rotation from

1. first rotating about z-axis and then about y-axis, both with angles of  $90^\circ$
2. first rotating about y-axis and then about z-axis, both with angles of  $90^\circ$

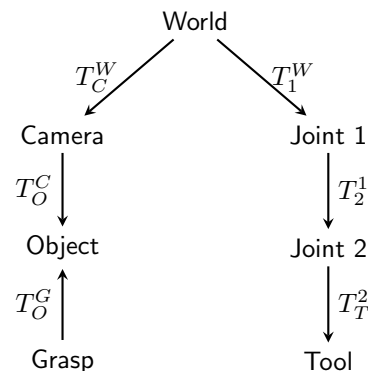
Compare the results!

**Task 0.2, Rotation matrix:** Determine the rotation matrix  $R_1^0$  that transform coordinates from frame 1 into coordinates of frame 0. The  $x_1, y_1$  axes lie within the  $y_0-z_0$ -plane, the  $z_1$ -axis is opposite to the  $x_0$ -axis.



**Task 0.3, Transforms:** Determine formulas for the following relative transforms given the shown transformation tree. Note the different directions of arrows, which define the direction of the available relative transform.

- Compute pose of tool in world
- Compute pose of object in world
- Compute grasp pose in world
- Compute motion to reach grasp pose



**Task 0.4, Inverse Rigid-Body Transform:** Verify the formula for the inverse rigid body transform given in the lecture:

$$\begin{pmatrix} R & \vec{t} \\ \vec{0}^t & 1 \end{pmatrix}^{-1} = \begin{pmatrix} R^t & -R^t \vec{t} \\ \vec{0}^t & 1 \end{pmatrix} = \begin{pmatrix} R^t & \vec{0} \\ \vec{0}^t & 1 \end{pmatrix} \cdot \begin{pmatrix} \mathbf{1} & -\vec{t} \\ \vec{0}^t & 1 \end{pmatrix}$$